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PRE-APPEAL BRIEF REQUEST FOR REVIEW

Docket Number (Optional): COHO-5040

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on June 9, 2008

Signature Georgia K. Stith

Typed or printed name Georgia K. Stith

Application Number	Filed
10/788,820	02/27/2004

First Named Inventor: Stuart Butterworth et al.

Art Unit	Examiner
2828	Delma Rosa Forde

Applicant requests review of the final rejection in the above-identified application. No amendments are being filed with this request.

This request is being filed with a notice of appeal.

The review is requested for the reason(s) stated on the attached sheet(s).
Note: No more than five (5) pages may be provided.

I am the

- ☐ applicant/inventor.
- ☐ assignee of record of the entire interest. See 37 CFR 3.71. Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96)
- ☑ attorney or agent of record. Registration number 29,444
- ☐ attorney or agent acting under 37 CFR 1.34. Registration number if acting under 37 CFR 1.34 _____

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June 9, 2008
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NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

☑ *Total of 1 forms are submitted.

For Application Serial No. 10/788,820

REASONS FOR REQUESTING PRE-APPEAL BRIEF REVIEW

The subject invention relates to an improvement for manufacturing an optically pumped semiconductor (OPS) laser. The primary reference cited by the Examiner (Salokatve, US 6,32,293) is commonly owned and fairly represents the prior art. Figure 1 from Salokatve is reproduced below.

In an OPS laser, the gain medium is in the form of a semiconductor chip 12 having a gain portion 16 and a mirror 14 which forms a part of the laser resonator. A second, spaced apart mirror 22 completes the resonator. The gain portion is optically pumped by laser diodes 26.

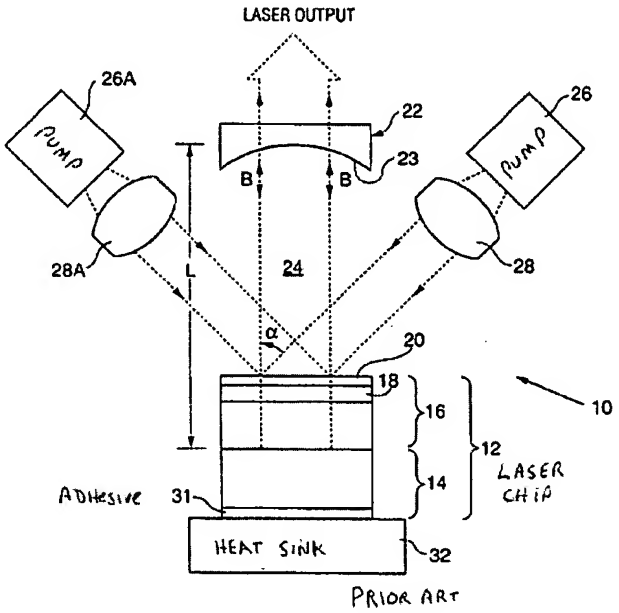

FIG. 1

In operation, these lasers generate heat. Therefore, the laser chip 12 is mounted on a heat sink 32 via an adhesive layer 31. As noted in the background section of the subject application, using an adhesive has certain problems. First, the adhesive typically acts as a thermal barrier, reducing heat flow into the heat sink. Second, thermally cycling can induce stresses.

Applicants therefore investigated alternative approaches for bonding the chip to the heat sink (or, more preferably, a diamond head spreader located between the chip and

the heat sink). Applicants' solution was to borrow a technique used in the optics field for many years to bond optical glass plates to each other. This approach is often called "optical contact bonding." Applicants' specification states at page 5, line 2:

> Chip 16 including OPS-structure 15 is **contact bonded** to surface 18A of the diamond heat spreader, here, with Bragg mirror structure 14 in contact with the heat spreader as depicted in FIG 1D. **The term "contact bonded", in this description and the appended claims, means that a bond is formed without a physical adhesive between the bonded members. Such a bond is comparable to an "optical contact" that is sometimes used in the optical industry to form an adhesive-free bond between smooth, flat components of optically transparent, solid materials such as glass or fused silica.** Once the contact bond has been formed, it is preferable, albeit not necessary, to heat or anneal the bonded assembly at a temperature between about 100°C and 350°C.

Further disclosure appears at page 10, line 13:

> It is preferable when optically contacting a diamond (CVD, natural or type IIa-synthetic) or any other highly thermally conductive heat spreader material to a semiconductor epitaxial layer structure, that the surfaces of both the layer structure and the heat spreader be very clean and very flat, preferably flattter than 0.2 waves at 635 nm. **Standard optical contacting methods are used, well known in the industry.** Regarding cleanliness, it is preferable that contacting be carried out on a class 100 clean bench and that surfaces be finally cleaned with an organic solvent such as acetone, methanol and iso-propanol. Once the heat spreader and the semiconductor chip are clean, one edge of the semiconductor chip is pressed against the heat spreader and the two surfaces are brought into contact with pressure. This usually requires multiple attempts of recleaning and contacting. Once a full surface optical contact has been made, the contacted, assembled structure is annealed at temperatures between 100°C and 350°C. Then the substrate supporting the semiconductor epitaxial layer structure is etched away, leaving the finished optical semiconductor device optically contacted to the heat spreader material.

All of pending independent claims are limited to using a pressure bond without adhesive.

In the Office Action, the Examiner cites the Bewley patent (6,448,642) for its teaching of a pressure bond between a heat sink and the laser chip. The Examiner argues that it would be obvious to the use the pressure bond of Bewley in the OPS laser structure of Salokatve. The problem with this argument is that Bewley's pressure bond **is not really a bond at all!** Bewley states at column 9, line 41, that the "bond is in no way

permanent. When the pressure is removed, the materials separate, without any damage to either surface."

The actual character of Bewley's bond is more apparent from an article Bewley wrote for Applied Physics Letters (of record herein, Vol. 74, No. 8). Here Bewley explains that his pressure bond is "created solely through the application of pressure, which was exerted from the back by a chisel-pointed screw" (page 1075 left, column). This sentence explains why Bewley's bond is not fixed and that the parts will separate when the screw is unscrewed.

In effort to expedite prosecution, applicants had amended the claims to distinguish over Bewley by stating that the pressure contact bond was of the type that would "remain fixed without adhesive after the pressure had been removed." While the underlined words did not expressly appear in the specification, applicants believed that anyone remotely skilled in the art reading specification would understand that the contact bond is permanent, unlike the Bewley's "bond" that comes apart when pressure is removed. More specifically, and as noted in the passages quoted above, a successful contact bond does not arise from pressure alone. Rather, the elements must be extremely flat and clean so that the surfaces can be brought together closely enough so that atomic forces can create the bond. In addition, the parts are preferably heated at high temperature to anneal the bond. Further confirmation that the bond is permanent appears in the specification at page 10, line 28, which notes the bonding can be performed at the wafer level followed by dicing of the laser chips. If applicants' optical contact bond were not permanent, the chips would fall apart when being diced.

Regardless of this detailed support in the specification, the Examiner has rejected the language added to the claims under §112 (lack of written description and indefinitness). In the Final Action dated March 17, 2008, the Examiner requested that the applicants provide evidence of what one skilled in the art knows about optical contact bonding. In a response filed on May 1, 2008, applicants submitted the Smart article and the Hickey patent (5,724,185) both of which establish that optical contact bonding is old, well known and provides a near permanent bond.

In the subsequent advisory action, the Examiner did not even mention or discuss the evidence applicants submitted - evidence which the Examiner himself requested.

There are two issues that should be considered during the pre-appeal brief review. The first is whether the intrinsic and extrinsic evidence demonstrates that there is sufficient §112 support for the language added to the claims. In this regard, it should be noted that applicants mere characterizing of the connection as a "bond" inherently implies permanence, and should have been sufficient to provide §112 support to the claim language. The current dispute only arises because of applicants good faith effort to add language to make it clear that applicants' bond is not the same as Bewley's so called "bond." Regardless, one skilled in the art reading the sections of the specification quoted in this document would unquestionable understand that applicants' bond would remain fixed after pressure was removed.

The second issue relates to the prior art rejection. A review of the prior art rejection reveals that the Examiner has simply chosen **to ignore** the limitation that the bond remains fixed after pressure is removed. Rather, the Examiner simply states that Bewley teaches a "bond" without adhesive. As noted above, Bewley fails to teach bond in the conventional meaning of the word and certainly fails to teach the type of optical contact bond being claimed herein. Assuming a decision by the panel is made that the language in the claims relating to the bond remaining fixed after the pressure has been removed is acceptable under §112, then the prior art rejection must also be withdrawn.

As a final point, applicants recognize that arguing that optical contact bonding is well known could raise the issue that it would have been obvious to use that approach in place of adhesive. However, the reason this combination would **not** have been obvious, is that, to best of applicants' knowledge, optical contact bonding had been generally used to bond two glass type materials. Applicants' recognition that this approach might also be useful for a completely different purpose, namely, bonding a semiconductor chip to a diamond heat spreader is inventive.

Each of the four independent claims (1, 16, 19 and 21) cover pressure contact bonding a semiconductor gain structure to a heat conducting element in a manner so that

the bond remains fixed after pressure is removed. This combination is not taught or suggested by any of the prior art of record and therefore these claims should be allowed.